Validation of the “Best-Fit Circle” for Bone Loss Based Upon Glenoid Height

Makovicka JL, Rodriguez M, Hassebrock JD, Chung AS, Tokish JM
Mayo Clinic Arizona
John Tokish:
Arthrex Consultant
Glenoid bone loss has been shown to be a key contributor to recurrent shoulder instability, with the amount of bone deficiency dictating surgical management of this condition.

- A “best-fit circle” based on the assumption that the inferior 2/3 of the glenoid approximates a true circle has been used in various methods, but the accuracy of a perfect circle approximation has been called into question as numerous glenoids are oval shaped, rather than circular.
Purpose

• No previous study has directly measured the actual ratio of the circle diameter and quantitatively validated how large the diameter should be based on glenoid height.

• The purpose of this study was to assess the assumption that the inferior “2/3” of the glenoid approximates a true circle.
Methods

- Morphology of the native glenoid was evaluated using magnetic resonance imaging (MRI) in 112 shoulders in patients without a history of instability.

- Using sagittal T1 MRI images, two observers approximated a perfect circle on the inferior glenoid using the previously published “best-fit circle” technique. Glenoid height, as measured from the supraglenoid tubercle to the base of the glenoid, was also determined.
• Subsequently, the point at which the diameter of the “best-fit circle” intersected the glenoid height was recorded to determine the percentage of the glenoid that approximated a true circle.
Results

- Using results of glenoid height and “best-fit circle” diameter, the diameter of the “best-fit circle” was found to intersect the glenoid line at 68.8% of the glenoid height.

- The inter and intra-rater reliability was excellent for glenoid height (Inter-rater: 0.89, 95% CI: 0.84-0.92, p<0.001; Intra-rater: 0.89, 95% CI: 0.84-0.92, p<0.001).

- The inter and intra-rater reliability was good to excellent for “best-fit circle” diameter (Inter-rater: 0.76, 95% CI: 0.67-0.83, p<0.001; Intra-rater: 0.74, 95% CI: 0.64-0.81, p<0.001).
Conclusion

• This study confirms with high accuracy the assumption that the inferior 2/3 of the glenoid approximates a true circle.

• We determined that the diameter of a true circle drawn on the inferior glenoid using the “best-fit circle” technique corresponds to 68.8% of the glenoid height.

• Using knowledge gained from these results, a perfect circle with a diameter of 2/3 glenoid height can be drawn from the inferior glenoid to measure bone loss. We would recommend using this technique to aid in drawing a true circle in cases where the “best-fit circle” technique may be difficult, such as when the inferior glenoid contour is not well defined.